Novel Single Photon Counting Readout Circuits and APD Arrays with capability from UV to IR, Phase I

Completed Technology Project (2009 - 2009)

Project Introduction

The overall goal of the proposed Phase I SBIR project is to develop and demonstrate 256x256 segmented readout integrated circuits (ROICs) that can read, digitize and count the response of linear-mode single photon counting avalanche photodiode (APD) pixels with picosecond readout capability and bandwidth at least an order of magnitude better than currently available ROICs. We will accomplish this by designing an ultrahigh speed front-end amplifier for an existing ROIC architecture that will be capable of low noise, wideband amplification of picosecond photocurrent pulses induced by single photons in the APD. In Phase I of this project, we will design, model and simulate the performance of higher speed ROIC analog front ends that will enable readout speed enhancement by as much as a factor of 10 compared to the performance of existing ROICs. In Phase II, we will design, fabricate and test 256 x 256 ultra-high speed ROICs and 256 x 256 linear-mode APD arrays.

Anticipated Benefits

Potential NASA Commercial Applications: Non-NASA and commercial applications for the proposed ROIC and APD arrays include: · Airborne 3-D imaging LADAR transmitter/sensor (and sophisticated image processing) to penetrate dense trees and camouflage in order to detect, identify, and characterize targets on the battlefield such as tanks and armored personnel carriers. · Exoatmospheric Kill Vehicle (EKV) seekers: uses three passive sensors (one visible and two infrared (IR)) for acquisition, tracking, limited discrimination, and aim point selection in the terminal homing phase. · Passive imaging camera with the capability of generating real-time displays of imaging scene. The FPAs of such cameras can be fabricated in high volume and at low cost; · Commercial detectors operating in the 1.1mm-1.5mm wavelength range are widely used for fiber optic communications. · Ultra-sensitive detectors and receivers for free space communication;

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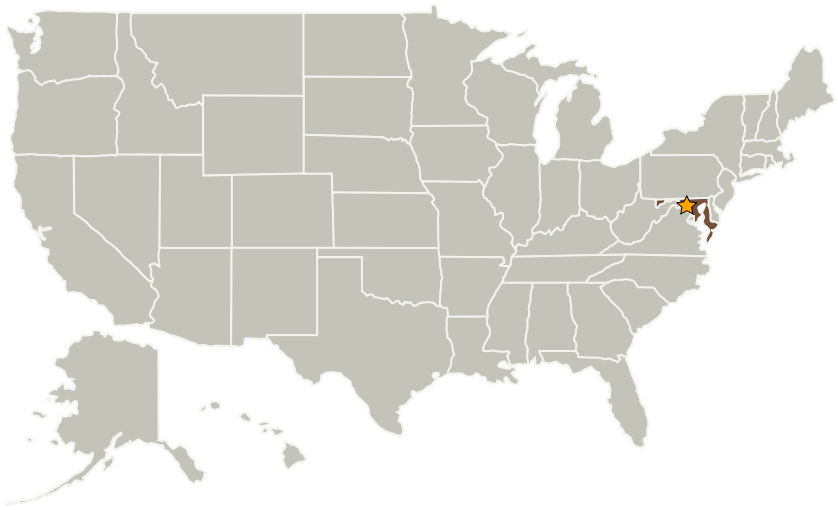
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
Epitaxial Technologies, LLC	Supporting Organization	Industry	Baltimore, Maryland

Primary U.S. Work Locations
Maryland

Project Transitions

January 2009: Project Start

July 2009: Closed out

Closeout Summary: Novel Single Photon Counting Readout Circuits and APD A rrays with capability from UV to IR, Phase I Project Image

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Project Manager:

Sachi Babu

Principal Investigators:

Olaleye A Aina
Leye Aina

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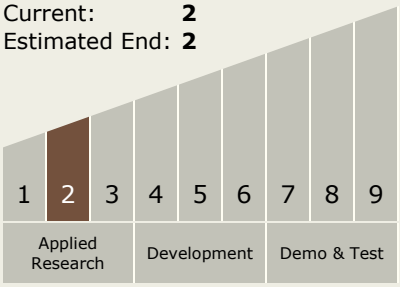
Technology Maturity (TRL)

Start: **2**
Current: **2**
Estimated End: **2**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes